Advanced technology in foot and ankle disorders

Updated knowledge or technique on insole

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Foot Orthotics Insole Market (Leather, Polypropylene and Others) by End-user (Sports, Medical and Others): Global Industry Perspective, Comprehensive Analysis, Size, Share, Growth, Segment, Trends and Forecast, 2015 - 2021

Published: Jul-2016 | Format: PDF | Zion | Number of pages: 100 | Code: MRS - 68173

Foot Orthotic Insoles Market to Reach 3.5 USD Billion By 2020

USA - English

NEWS PROVIDED BY
IndustryARC →
Feb 29, 2016, 10:30 ET

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HYDERABAD, India and MINNEAPOLIS, February 29, 2016 /PRNewswire/ --

According to the Market Report, "**Foot Orthotic Insoles Market Analysis: By Type (Custom, Prefabricated); By End User (Sports (Running, Court); Medical (Diabetes, Rheumatoid Arthritis, Plantar Fasciitis, Metatarsalgia, Obesity); Comfort) - With Forecast (2015 - 2020)**" by IndustryARC, the market is estimated to reach 3.5 USD Billion by 2020 at high CAGR.

General views

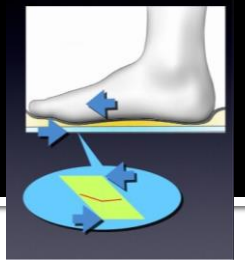
- Soft tissue protection
- Bone/joint stability
- Control of body segment motions

Roles in the nonoperative treatment of foot and ankle pathology

Indications

- Off-load areas of high pressure and decrease shear forces
- Cushion vulnerable soft tissue sites (ex. diabetics)
- Correct flexible deformities and accommodate rigid deformities (ex. pes planovalgus)
- Eliminate painful motion (ex. hallux rigidus)
- Replace lost motion, improve gait and ambulation (ex. ankle fusion)

Common 6 goals



- Shock attenuation and absorption
- Provide cushion to tender areas of foot
- Relieve areas of abnormal increased plantar pressure
- Attempt correction of flexible deformities
- Restrict motion of painful joints
- Try to accommodate rigid deformities

Support and stability

Principals

- Patients
  - Underlying disease (DM, RA, CMT…)
  - Functional level
  - Pathology
    - Soft tissue condition
    - Flexible or rigid deformity
    - Pain
    - Neurologic status
- Orthotics
  - Correction or accommodate
  - Materials
  - Design
    - Weight
    - Durable
  - Manufacturing

Ready made (prefabricated) insole

Insoles for Every Shoe & Foot Type:

OFG Insoles

Adjustable arch support. Excellent cushioning. Fit shoes with removable insoles, 1/4" at the toes.

$39.95 ~~$49.95~~

LEARN MORE

Biosole-Gel Women's Dress

Ideal for shoes with non-removable insoles and shoes with a slim silhouette, such as heels and narrow flats. ¾ length.

$39.95 ~~$49.95~~

LEARN MORE

Biofit Soft

Moderate support. Soft & Cushioning. Ideal for sensitive feet, diabetes, arthritis and neuropathy. For shoes with removable insoles, ¼" at the toes.

$39.95 ~~$49.95~~

LEARN MORE

HRI (3/4 Length)

Enhanced arch support. Ideal for shoes with non-removable insoles, excluding heels.

$39.95 ~~$49.95~~

LEARN MORE

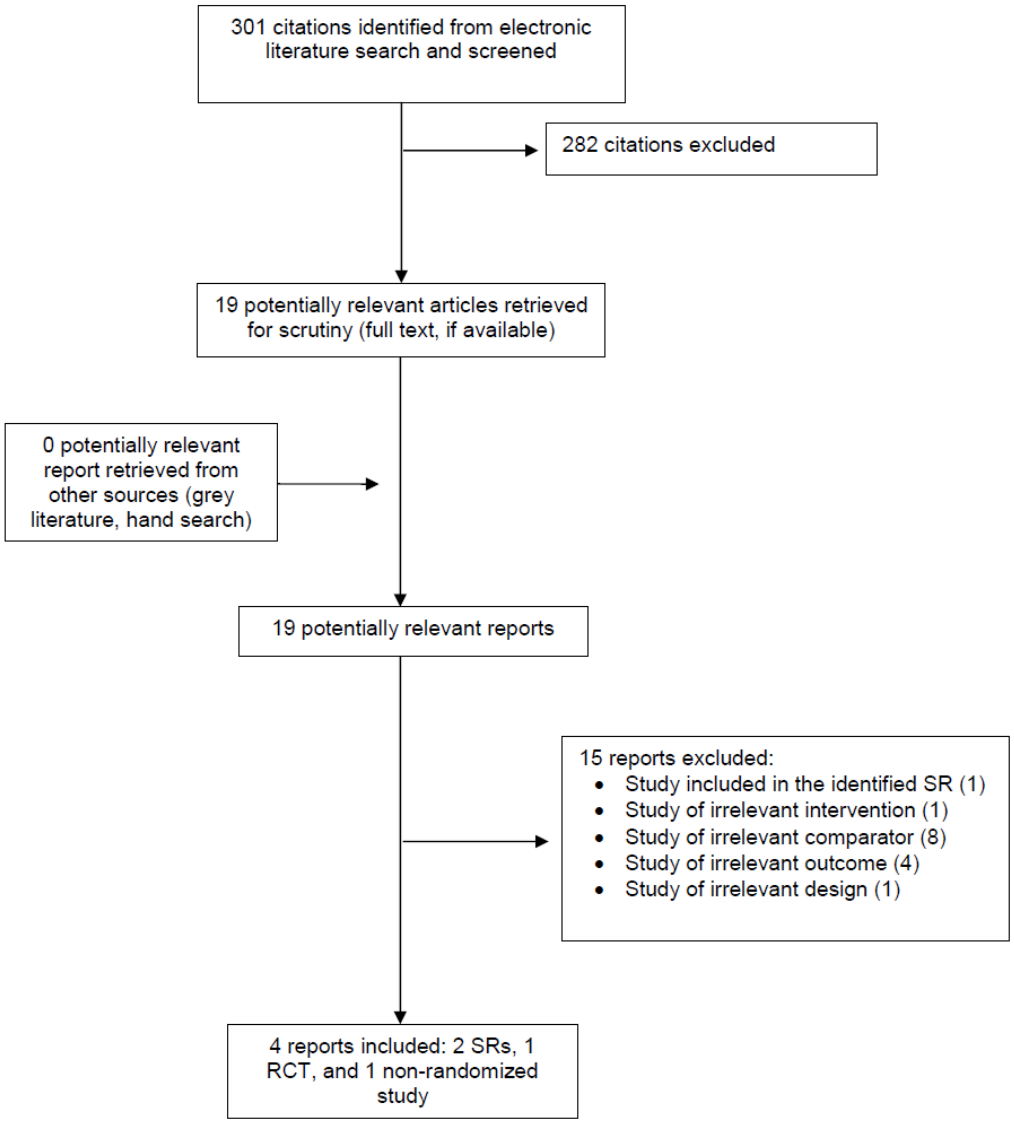
Custom-Made Foot Orthoses versus Prefabricated foot Orthoses: A Review of Clinical Effectiveness and Cost-Effectiveness

CADTH Rapid Response Report: Summary with Critical Appraisal

Khai Tran and Carolyn Spry.

Ottawa (ON): Canadian Agency for Drugs and Technologies in Health; 2019 Sep 23.

Appendix 1: Selection of Included Studies



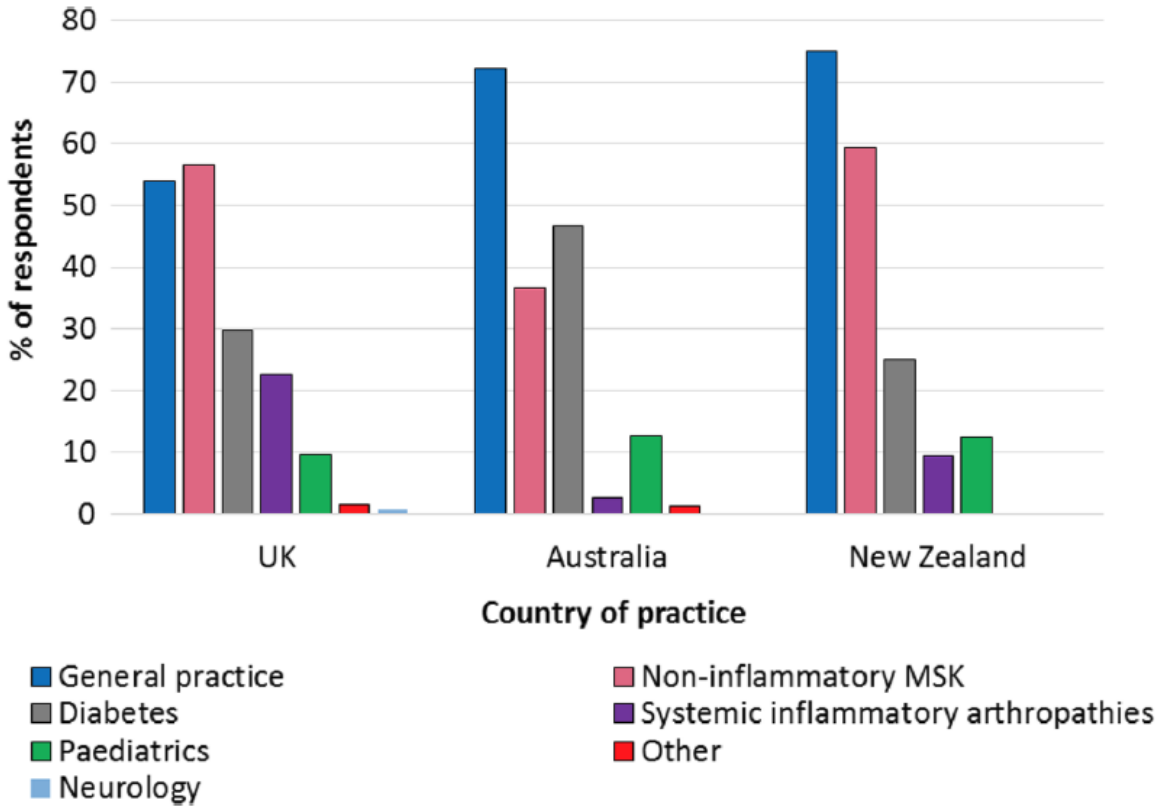
4 reports

- 2 SR
- 1 RCT
- 1 non-RCT

Patient Characteristics	Types of Comparisons, Treatment Setting, Duration of Treatment
Adult patients with clinical diagnosis of plantar heel pain Mean age: 44 to 49 years % Female: 63 to 75 Duration of pain: < 1 year	Customized (n = 226) Prefabricated (n = 223) Setting: Clinics for podiatric care Treatment duration: 2 weeks to 12 months
Adult patients with clinical diagnosis of plantar heel pain Mean age: 47.3 to 49.6 years % Female: 63 to 76 Duration of pain: NR	Customized (n = 214) Prefabricated (n = 199) Setting: Clinics for podiatric care Treatment duration: 2 weeks to 12 months

A survey of foot orthoses prescription habits amongst podiatrists in the UK, Australia and New Zealand

- 264 podiatrists
- 19 countries



Chapman *et al. Journal of Foot and Ankle Research* (2018) 11:64

RESEARCH Open Access

'Trial and error…', '…happy patients' and '…an old toy in the cupboard': a qualitative investigation of factors that influence practitioners in their prescription of foot orthoses

Williams *et al. Journal of Foot and Ankle Research* (2016) 9:11

4. Williams AE, Davies S, Graham A, Dagg A, Longrigg K, Lyons C, Bowen CJ. Guidelines for the management of the foot health problems associated with rheumatoid arthritis. Musculoskeletal Care. 2011;9(2):86–92.
5. van Netten JJ, Price PE, Lavery LA, Monteiro-Soares M, Rasmussen A, Jubiz Y, Bus SA, et al.; on behalf of the International Working Group on the Diabetic Foot (IWGDF). Prevention of foot ulcers in the at-risk patient with diabetes: a systematic review. 2015; doi: 10.1002/dmrr.2701
6. National Insistute for Health and Care Excellence. Diabetic foot problems: prevention and management. 2015. http://www.nice.org.uk/Guidance/NG19. Accessed 17/11/15.
7. North West Clinical Effectiveness Group for Diabetes. Guidelines for the prevention and management of foot problems for people with diabetes. 2014; http://www.footindiabetes.org/media/fduk/North_West_Guidelines_2014.pdf. Accessed 17/11/15.

Efficacy of foot orthoses: what does the literature tell us?

(i) *patient satisfaction*

(ii) *pain and deformity*

(iii) *plantar pressure*

(iv) *position and motion*

(v) *muscle activity*

(vi) *oxygen consumption*

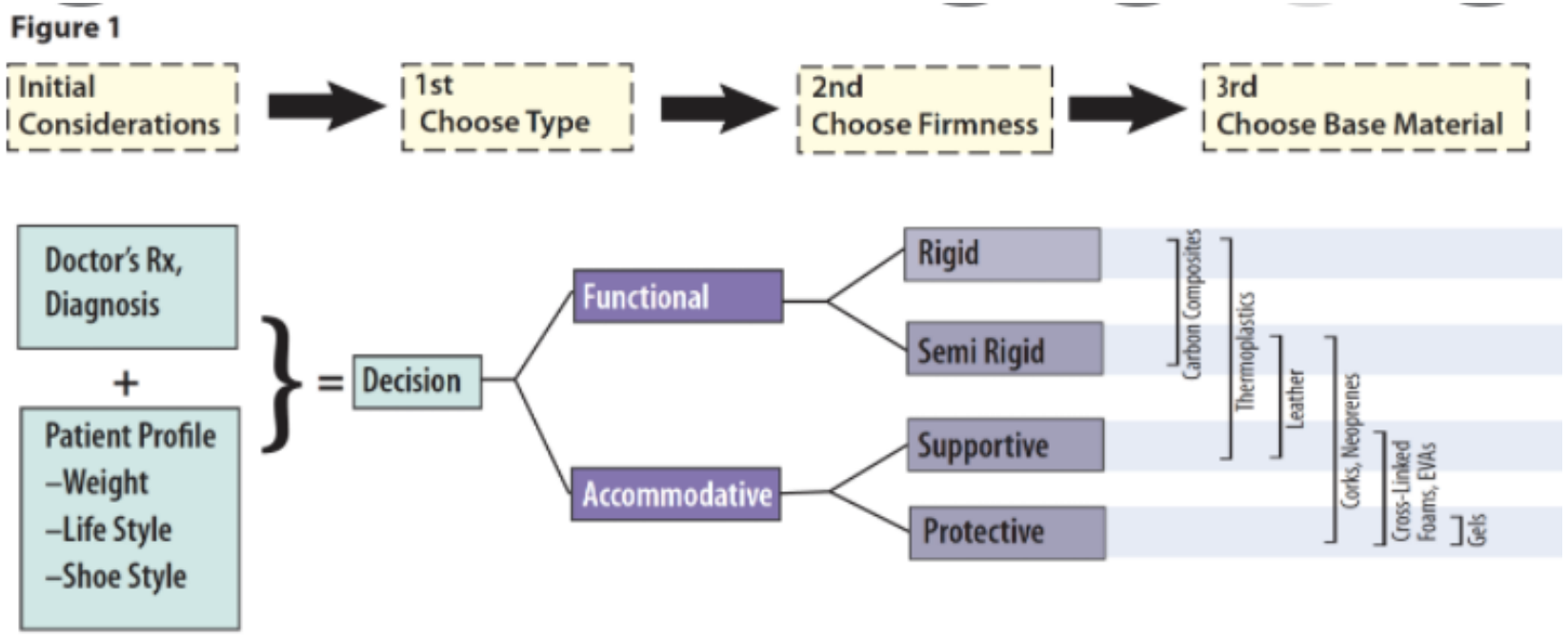
Custom made insole

- More intimate fit
- Can be modified to individual differences
- Can apply greater correction and accommodation

Classification

- Soft
  - Shock absorption
  - Reduction of shear force
- Rigid
  - Control for flexible deformity
  - Restrict motion of painful joints
- Semirigid/Semiflexible

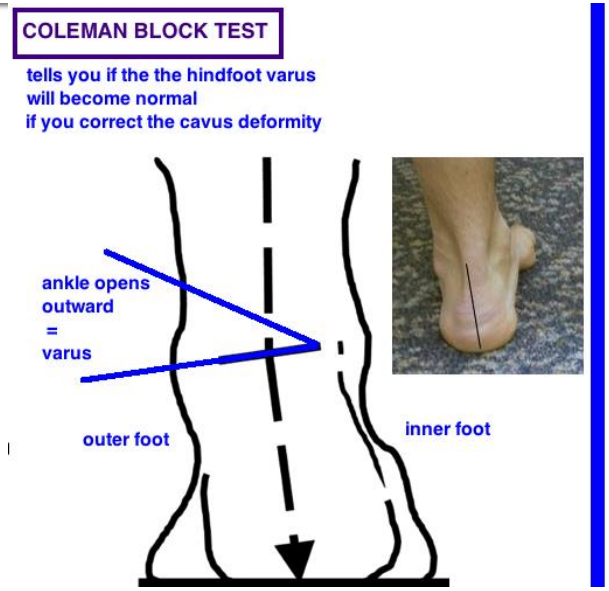
Prescriptions

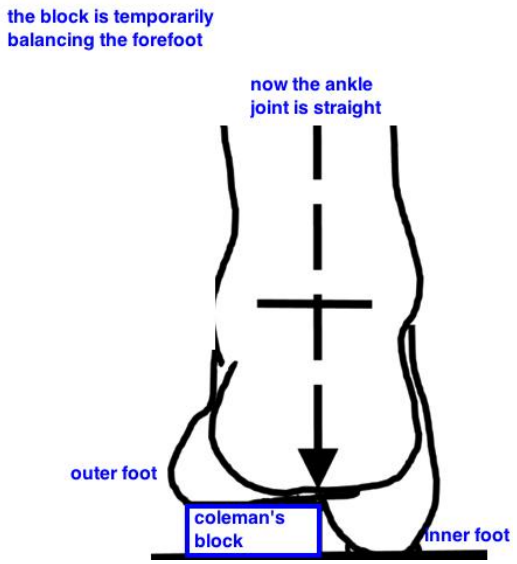


https://hersco.com/education-center/foot-orthotic-materials/

Functional vs accommodative

- Functional
  - Toward a neutral position
- Accommodative
  - Rigid conditions
  - Pressure alleviation



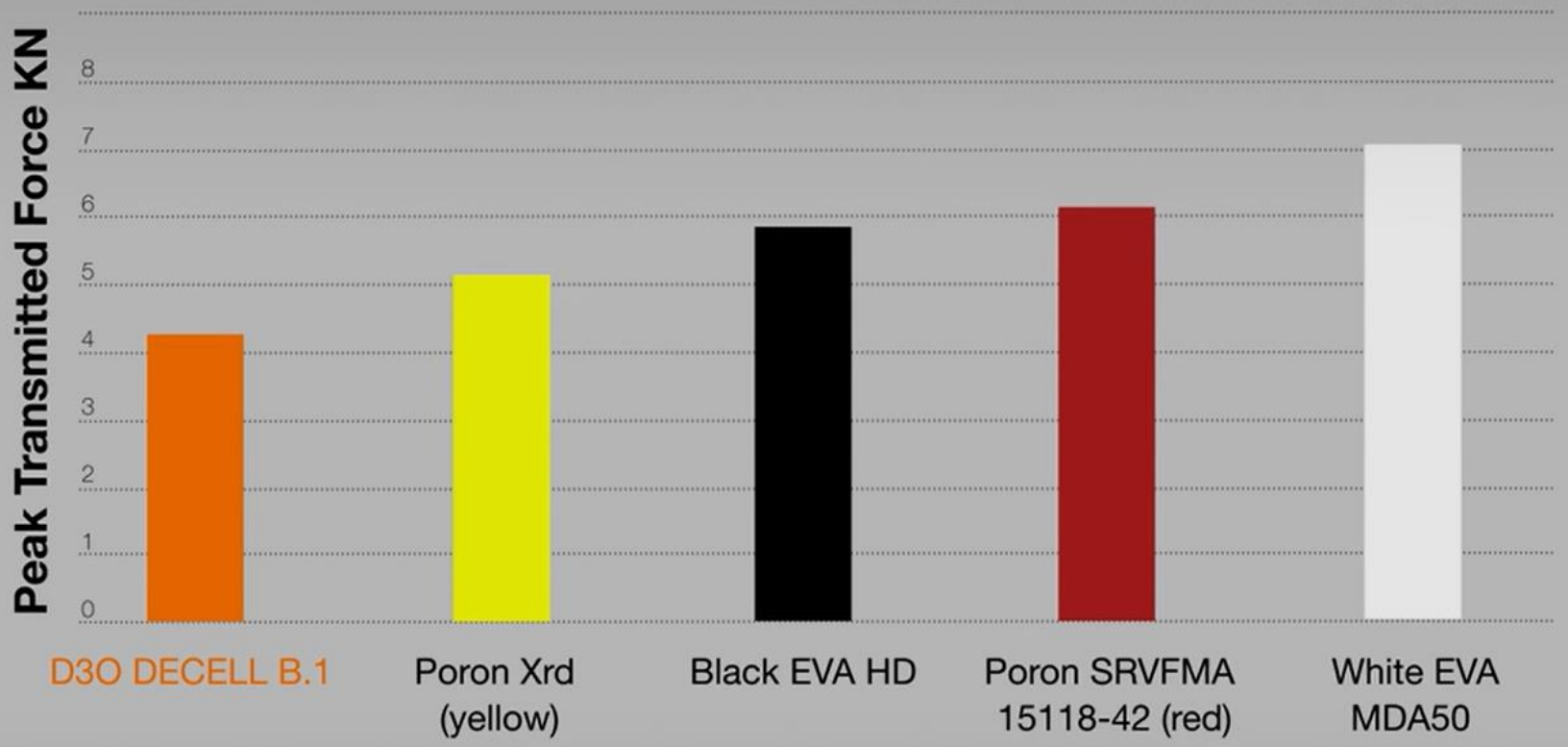


REVIEW Open Access

Effect of different orthotic materials on plantar pressures: a systematic review

- Polyurethane (including PORON®)
- Polyethylene (including Plastazote®)
- Ethyl vinyl acetate (EVA)
- Rubber foam (neoprene)

Gerrard *et al. Journal of Foot and Ankle Research* (2020) 13:35
https://doi.org/10.1186/s13047-020-00401-3

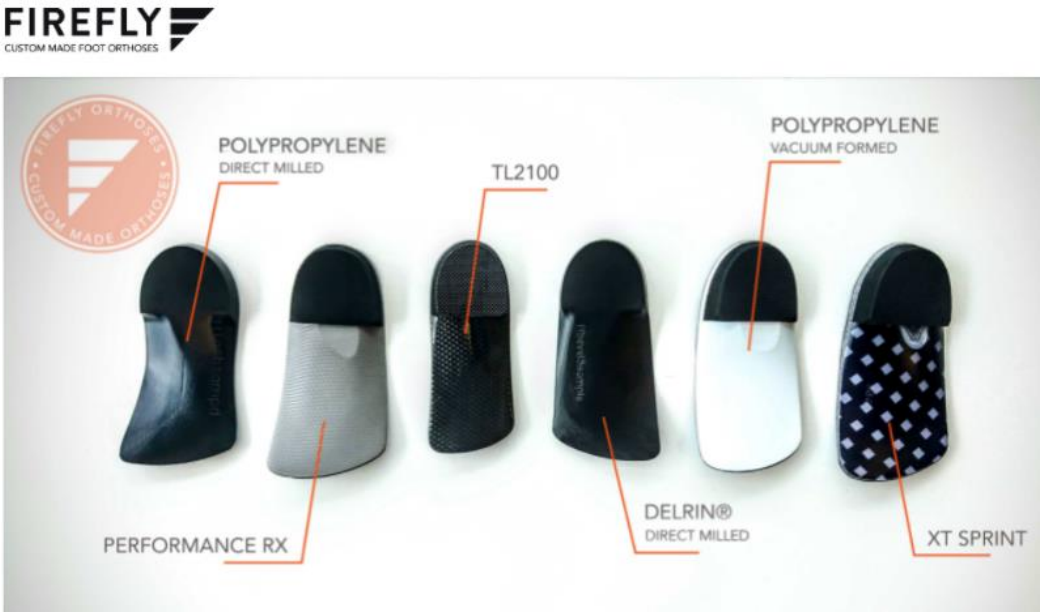


D3O offers, on average, 33% more shock attenuation than the leading competitor materials in the market.

https://playtv.kakao.com/embed/player/cliplink/vd7b7DOoo1VVVj9VnvADoKU@my?service=player_share

Shell materials

- Polypropylene
- Carbon graphite composites
- Subortholen
- Copolymer



From flexible to rigid

Level Control

Use: Choice of biomechanical control with sport, functional and podopediatric applications

Materials: Select polypropylene shell •High durometer EVA rearfoot post •Protective post plate •Intrinsic forefoot post •Vinyl cover

Level Control Shell Guidelines

Make Selection	<100 lbs	100-150 lb	151-200 lb	201-250 lb	>250 lb
☐2.5mm (3/32")	Semirigid	Flexible	Very Flexible		
☐3mm (1/8")	Rigid	Semirigid	Flexible	Very Flexible	
☐4mm (5/32")	Very Rigid	Rigid	Semirigid	Flexible	Very Flexible
☐5mm (3/16")		Very Rigid	Rigid	Semirigid	Flexible
☐6mm (1/4")			Very Rigid	Rigid	Semirigid

https://performlab.com/index.php?option=com_insoles&view=rxform

Cast Correction

Rear Foot: (Total) _____ _____ Left Right

Fore Foot: _____ _____ (+/-) Left Angle (+/-) Right Angle

Arch Fill Technique

Inverted: L R Mid: L R Modified Root: L R

Optional: *Min. Arch Fill* L R *Max. Arch Fill* L R

Cast Modifications

Medial Heel Skive: S M L L R

Tri-Planar Heel Shave: L R

No Plaster Fill B/W 1/5: L R

Cuboid Notch: S M L L R

Plantar 5th Ray Grind: L R

Plantar Fascial Accommodation: L R

1st Ray Accommodation: L R

Extra Heel Expansion: L ____ mm R ____ mm

Medial Flare: L R

Medial Wrap: L R

Other: _____

Shell Material

Polypropelene	Carbon Fibre (Superform)	EVA
6.0 mm ○	Semi-Rigid ○	Soft ○
5.0 mm ○	Semi-Flex ○	Medium ○
4.5 mm ○		Hard ○
4.0 mm ○		
3.5 mm ○		EVA Length
3.0 mm ○		3/4 ○
2.5 mm ○		Web ○
2.0 mm ○		Full ○

Other: _____

Shell Modification

Heel Aperture: S M L L R

Heel Aperture Poron Button: L R

Heel Aperture Cambrelle Button: L R

1st Ray Cut-Out: L R

Lateral Plantar Grind: L R

Gait Plate: L R

Shell Shape

Cover

Shape		Material			
No Cover Polished:	○	Vinyl:	○		
No Cover Rough:	○	Leather:	○		
Standard	○	PS Vlies:	○		
Standard Plus:	○	Lunasoft:	○		
Web:	○	Poron:	○ 1.5	○ 3.0	○ 3.0 Red
Full:	○	Spenco:	○ 1.5	○ 3.0	
		Cambrelle Base:	○		

Manufacturing

Foam box for foot impressions

https://www.craryshoes.com/

Thermoforming

Casting

- Non-Weightbearing Neutral Position Cast of the Foot

From Park In Sik, Biomechanics

ORIGINAL ARTICLE

Computer-Aided Design of Customized Foot Orthoses: Reproducibility and Effect of Method Used to Obtain Foot Shape

Arch Phys Med Rehabil 2012;93:863-70.

Design Parameter	Plaster Cast	Foam Box Sitting	Foam Box Walking	$ICC_{(2,1)}$ (95% CI) 3D Scan (Relaxed Standing)
Length	0.88 (0.66–0.95)	0.93 (0.85–0.97)	0.88 (0.74–0.95)	0.92 (0.74–0.97)
Forefoot width	0.89 (0.75–0.95)	0.90 (0.59–0.97)	0.89 (0.69–0.96)	0.81 (0.59–0.92)
Heel width	0.86 (0.70–0.94)	0.91 (0.79–0.96)	0.88 (0.74–0.95)	0.93 (0.67–0.98)
Medial arch height	0.64 (0.32–0.83)*	0.41 (0.02–0.70)*	0.48 (0.07–0.75)*	0.73 (0.45–0.88)*
FF/RF angle	0.65 (0.33–0.84)*	NA	NA	0.83 (0.64–0.93)
Shape match, % (SD)	76.4 (11.5)	77.6 (6)	73.9 (10.8)	79.1 (8.8)

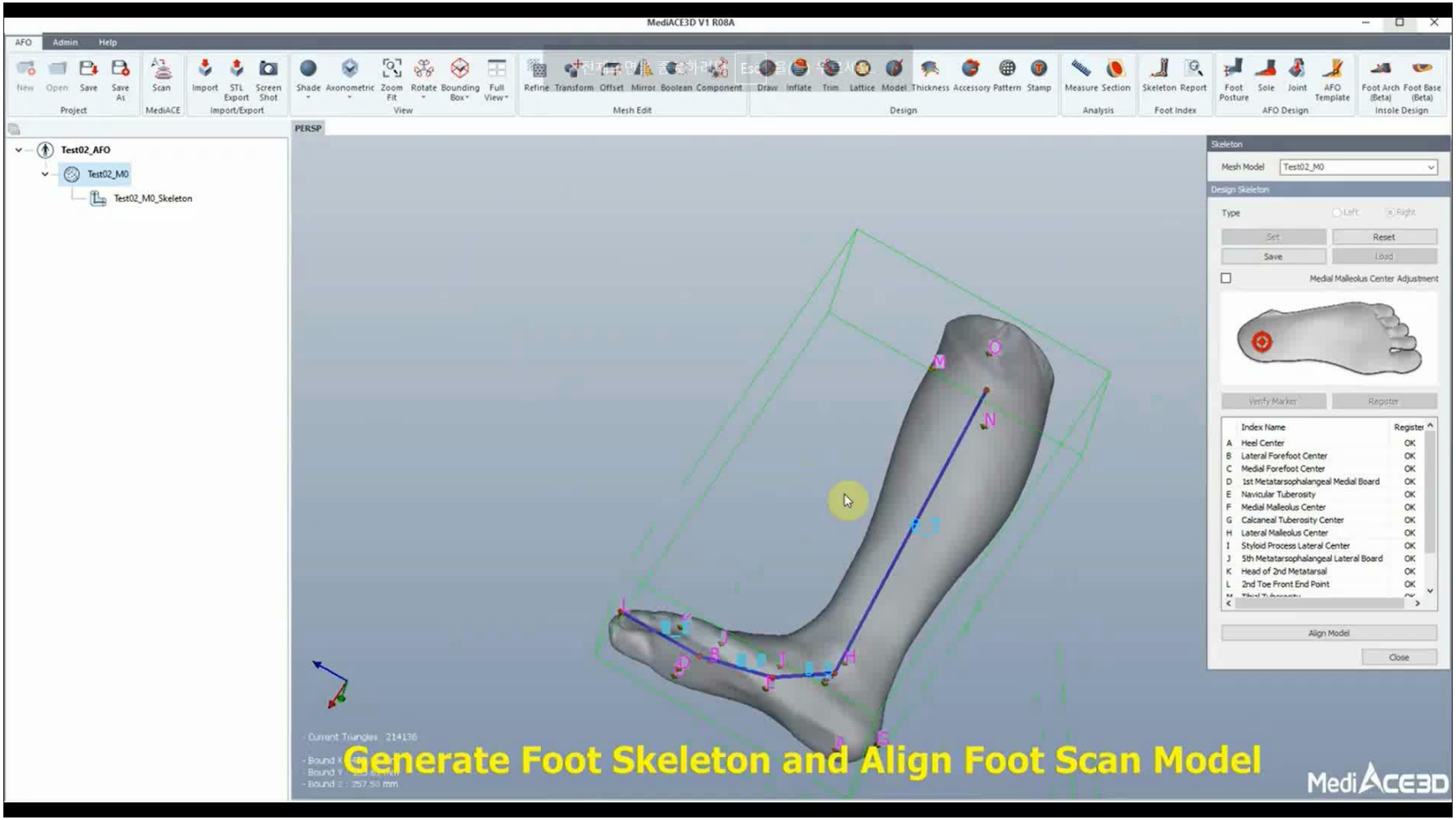
Table 3: Intercaster Reliability

3D scanner

Mediace3d

https://www.youtube.com/watch?v=e5QKE78rd-k

3D printing



Mediace3d

3D printing

https://www.youtube.com/watch?v=VOQx9HTXs88

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"…it provided too much info… its ok for research but for clinical use it is difficult to navigate through all of it…you normally use 10 % of the software, because most of the information is not useful for clinic, it is for research…it also doesn't replicate the foot in sufficient detail. The manufacturers don't produce kit that is clinically useful".

Insoles- summary

- Roles in the nonoperative treatment of foot and ankle pathology
- Growing industries or clinics
- Current insole practice is variable
- New technologies can enhance insole prescription and outcome measurement

- 감사합니다.